STORM WATER MANAGEMENT PLAN

1505 YORK DRIVE
COUNTY of SAN DIEGO
ER 87-08-036A/Tract No. 5443 RPL 3

Prepared for:

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October 28, 2008

W.O. 757-1019-400

Storm Water Management Plan
For Priority Projects
(Major SWMP)

Project Name:	1505 York Drive - W.O.757-1019-400
Permit Number (Land Development Projects):	ER 87-08-036A
Work Authorization Number (CIP):	
Applicant:	Gary Van Elk
Applicant's Address:	841 Quails Trail Vista, CA 92081
Plan Prepare By (*Leave blank if same as applicant*):	BHA, Inc. 5115 Avenida Encinas Suite L Carlsbad, Ca 92008-4387
Date:	March 24, 2008
Revision Date (If applicable):	October 28, 2008 (Addendum)

The County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance (WPO) (Ordinance No. 9424) requires all applications for a permit or approval associated with a Land Disturbance Activity must be accompanied by a Storm Water Management Plan (SWMP) (section 67.804.f). The purpose of the SWMP is to describe how the project will minimize the short and long-term impacts on receiving water quality. Projects that meet the criteria for a priority project are required to prepare a Major SWMP.

Since the SWMP is a living document, revisions may be necessary during various stages of approval by the County. Please provide the approval information requested below.

Project Review Stage	Does the SWMP need revisions?		If YES, Provide Revision Date
	YES	NO	
Tentative Parcel Map (Add Attachment H - Addendum)	✓		October 28, 2008
		✓	
		✓	

Instructions for a Major SWMP can be downloaded at http://www.co.san-diego.ca.us/dpw/stormwater/susmp.html.

Completion of the following checklist and attachments will fulfill the requirements of a Major SWMP for the project listed above.

PROJECT DESCRIPTION

Please provide a brief description of the project in the following box. For example:
The 50-acre RC Ranch project is located on the south side of San Miguel Road in the County of San Diego (See Attachment 1). The project is approximately 1.0 mile east of the intersection of San Miguel Avenue and San Miguel Road and 1 mile south of the Sweetwater Reservoir. This project will consist of a planned residential community comprising of 45 single-family homes 72 and multi-unit dwellings.

York Drive is located on the western side of York Drive, near York View Circle and approximately 3000 feet south of Monte Vista Drive. Currently, two single family residences occupy the site.

The project proposed the development of 5 pads for the construction of single family homes, the private road, and infrastructures. One of the existing home will be demolished and removed. While the other home, the one nearest to York Drive, will remain.

PRIORITY PROJECT DETERMINATION

Please check the box that best describes the project. Does the project meet one of the following criteria?

PRIORITY PROJECT	YES	NO
Redevelopment within the County Urban Area that creates or adds at least 5,000 net square feet of additional impervious surface area	✓	
Residential development of more than 10 units		✓
Commercial developments with a land area for development of greater than 100,000 square feet		✓
Automotive repair shops		✓
Restaurants, where the land area for development is greater than 5.000 square feet		✓
Hillside development, in an area with known erosive soil conditions, where there will be grading on any natural slope that is twenty-five percent or greater, if the development creates 5,000 square feet or more of impervious surface		✓
Environmentally Sensitive Areas: All development and redevelopment located within or directly adjacent to or discharging directly to an environmentally sensitive area (where discharges from the development or redevelopment will enter receiving waters within the environmentally sensitive area), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition.		✓
Parking Lots 5,000 square feet or more or with 15 parking spaces or more and potentially exposed to urban runoff		✓
Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater	✓	

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered priority projects. Parking lots, buildings and other structures associated with utility projects are subject to SUSMP requirements if one or more of the criteria above are met.

If you answered **NO** to all the questions, then **STOP**. Please complete a Minor SWMP for your project.

If you answered **YES** to any of the questions, please continue.

The following questions provide a guide to collecting information relevant to project stormwater quality issues. Please provide a description of the findings in text box below.

	QUESTIONS	COMPLETED	NA
1.	Describe the topography of the project area.	✓	
2.	Describe the local land use within the project area and adjacent areas.	✓	
3.	Evaluate the presence of dry weather flow.	✓	
4.	Determine the receiving waters that may be affected by the project throughout the project life cycle (i.e., construction, maintenance and operation).	✓	
5.	For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern.	✓	
6.	Determine if there are any High Risk Areas (municipal or domestic water supply reservoirs or groundwater percolation facilities) within the project limits.	✓	
7.	Determine the Regional Board special requirements, including TMDLs, effluent limits, etc.		✓
8.	Determine the general climate of the project area. Identify annual rainfall and rainfall intensity curves.	✓	
9.	If considering Treatment BMPs, determine the soil classification, permeability, erodibility, and depth to groundwater.	✓	
10.	Determine contaminated or hazardous soils within the project area.	✓	

Please provide a description of the findings in the following box. For example:
The project is located in the San Diego Hydrologic unit. The area is characterized by rolling grassy hills and shrubs. Runoff from the project drains into a MS4 that eventually drains to Los Coches Creek. Within the project limit there are no 303(d) impaired receiving water and no Regional Board special requirements.

The project area is characterized by medium slope and rural residential use land with grassy areas and trees.
On-site topographic elevation ranges from 490 feet to 450 feet above mean sea level. York Drive is within the Buena Hydrologic Subarea (904.32); it is part of the Carlsbad Hydrologic Area (904). The site is occupied with two single family residences, moderately slope, with type "B" soil. This project is not on the 303(d) list and no contaminated or hazardous soil within the project area.

Complete the checklist below to determine if Treatment Best Management Practices (BMPs) are required for the project.

No.	CRITERIA	YES	NO	INFORMATION
1.	Is this an emergency project		✓	If YES, go to 6. If NO, continue to 2.
2.	Have TMDLs been established		✓	If YES, go to 5.

No.	CRITERIA	YES	NO	INFORMATION
	for surface waters within the project limit?			If NO, continue to 3.
3.	Will the project directly discharge to a 303(d) impaired receiving water body?		✓	If YES, go to 5. If NO, continue to 4.
4.	Is this project within the urban and environmentally sensitive areas as defined on the maps in Appendix B of the *County of San Diego Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects*?		✓	If YES, continue to 5. If NO, go to 6.
5.	Consider approved Treatment BMPs for the project.		✓	If YES, go to 7.
6.	Project is not required to consider Treatment BMPs			Document for Project Files by referencing this checklist.
7.	End			

Now that the need for a treatment BMPs has been determined, other information is needed to complete the SWMP.

WATERSHED

Please check the watershed(s) for the project.

☐ San Juan	☐ Santa Margarita	☐ San Luis Rey	■ Carlsbad
☐ San Dieguito	☐ Penasquitos	☐ San Diego	☐ Pueblo San Diego
☐ Sweetwater	☐ Otay	☐ Tijuana	

Please provide the hydrologic sub-area and number(s)

Number	Name
904.32	Buena Hydrologic Subarea

Please provide the beneficial uses for Inland Surface Waters and Ground Waters. Beneficial Uses can be obtained from the Water Quality Control Plan For The San Diego Basin, which is available at the Regional Board office or at http://www.swrcb.ca.gov/rwqcb9/programs/basinplan.html.

SURFACE WATERS	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRESH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Inland Surface Waters	Buena (904.32)	X	X	X					X	X		X		X		
Ground Waters	Buena (904.32)	X	X	X												

X Existing Beneficial Use
● Potential Beneficial Use
★ Excepted from Municipal

POLLUTANTS OF CONCERN

Using Table 1, identify pollutants that are anticipated to be generated from the proposed priority project categories. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

Table 1. Anticipated and Potential Pollutants Generated by Land Use Type

	General Pollutant Categories								
Priority Project Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P[1]	P[2]	P	X
Commercial Development >100,000 ft²	P[1]	P[1]		P[2]	X	P[5]	X	P[3]	P[5]
Automotive Repair Shops			X	X[4][5]	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft²	X	X			X	X	X		X

	General Pollutant Categories								
Priority Project Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Note: If other monitoring data that is relevant to the project is available. Please include as Attachment C.

CONSTRUCTION BMPs

Please check the construction BMPs that may be used. The BMPs selected are those that will be implemented during construction of the project. The applicant is responsible for the placement and maintenance of the BMPs selected.

- ■ Silt Fence
- ■ Fiber Rolls
- ■ Street Sweeping and Vacuuming
- ■ Storm Drain Inlet Protection
- ■ Stockpile Management
- ■ Solid Waste Management
- ■ Stabilized Construction Entrance/Exit
- □ Dewatering Operations
- □ Vehicle and Equipment Maintenance
- ■ Desilting Basin
- ■ Gravel Bag Berm
- □ Sandbag Barrier
- ■ Material Delivery and Storage
- ■ Spill Prevention and Control
- ■ Concrete Waste Management
- ■ Water Conservation Practices
- ■ Paving and Grinding Operations
- ■ Any minor slopes created incidental to construction and not subject to a major or minor grading permit shall be protected by covering with plastic or tarp prior to a rain event, and shall have vegetative cover reestablished within 180 days of completion of the slope and prior to final building approval.

SITE DESIGN

To minimize stormwater impacts, site design measures must be addressed. The following checklist provides options for avoiding or reducing potential impacts during project planning. If

YES is checked, it is assumed that the measure was used for this project. If NO is checked, please provide a brief explanation why the option was not selected in the text box below.

	OPTIONS		YES	NO	N/A
1.	Can the project be relocated or realigned to avoid/reduce impacts to receiving waters or to increase the preservation of critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions?				◆
2.	Can the project be designed to minimize impervious footprint?		◆		
3.	Conserve natural areas where feasible?		◆		
4.	Where landscape is proposed, can rooftops, impervious sidewalks, walkways, trails and patios be drained into adjacent landscaping?		◆		
5.	For roadway projects, can structures and bridges be designed or located to reduce work in live streams and minimize construction impacts?				◆
6.	Can any of the following methods be utilized to minimize erosion from slopes:		◆		
	6.a.	Disturbing existing slopes only when necessary?	◆		
	6.b.	Minimize cut and fill areas to reduce slope lengths?	◆		
	6.c.	Incorporating retaining walls to reduce steepness of slopes or to shorten slopes?			◆
	6.d.	Providing benches or terraces on high cut and fill slopes to reduce concentration of flows?			◆
	6.e.	Rounding and shaping slopes to reduce concentrated flow?	◆		
	6.f.	Collecting concentrated flows in stabilized drains and channels?	◆		

Please provide a brief explanation for each option that was checked N/A or NO in the following box.

The project is raised so that the pads are above the 100 year flood inundation line.
This project does not cross any live stream.
No retaining wall is proposed.
No benches or terranes are proposed.

If the project includes work in channels, then complete the following checklist. Information shall be obtained from the project drainage report.

No.	CRITERIA	YES	NO	N/A	COMMENTS
1.	Will the project increase velocity or volume of downstream flow?		◆		If YES go to 5.
2.	Will the project discharge to unlined channels?		◆		If YES go to 5.
3.	Will the project increase potential sediment load		◆		If YES go to 5.

No.	CRITERIA	YES	NO	N/A	COMMENTS
	of downstream flow?				
4.	Will the project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect upstream and/or downstream channel stability?		◆		If YES go to 7.
5.	Review channel lining materials and design for stream bank erosion.	◆			Continue to 6.
6.	Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity.	◆			Continue to 7.
7.	Include, where appropriate, energy dissipation devices at culverts.	◆			Continue to 8.
8.	Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.	◆			Continue to 9.
9.	Include, if appropriate, detention facilities to reduce peak discharges.			◆	
10.	"Hardening" natural downstream areas to prevent erosion is not an acceptable technique for protecting channel slopes, unless pre-development conditions are determined to be so erosive that hardening would be required even in the absence of the proposed development.			◆	Continue to 11.
11.	Provide other design principles that are comparable and equally effective.			◆	Continue to 12.
12.	End	◆			

SOURCE CONTROL

Please complete the following checklist for Source Control BMPs. If the BMP is not applicable for this project, then check N/A only at the main category.

	BMP		YES	NO	N/A
1.	**Provide Storm Drain System Stenciling and Signage**		◆		
	1.a.	All storm drain inlets and catch basins within the project area shall have a stencil or tile placed with prohibitive language (such as: "NO DUMPING – DRAINS TO _____") and/or graphical icons to discourage illegal dumping.	◆		
	1.b.	Signs and prohibitive language and/or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area.	◆		
2.	**Design Outdoors Material Storage Areas to Reduce Pollution Introduction**				◆
	2.a.	This is a detached single-family residential project. Therefore, personal storage areas are exempt from this requirement.	◆		

		BMP	YES	NO	N/A
	2.b.	Hazardous materials with the potential to contaminate urban runoff shall either be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the storm water conveyance system; or (2) protected by secondary containment structures such as berms, dikes, or curbs.			◆
	2.c.	The storage area shall be paved and sufficiently impervious to contain leaks and spills.			◆
	2.d.	The storage area shall have a roof or awning to minimize direct precipitation within the secondary containment area.			◆
3.	**Design Trash Storage Areas to Reduce Pollution Introduction**				◆
	3.a.	Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; or,			◆
	3.b.	Provide attached lids on all trash containers that exclude rain, or roof or awning to minimize direct precipitation.			◆
4.	**Use Efficient Irrigation Systems & Landscape Design**		◆		
	The following methods to reduce excessive irrigation runoff shall be considered, and incorporated and implemented where determined applicable and feasible.				
	4.a.	Employing rain shutoff devices to prevent irrigation after precipitation.	◆		
	4.b.	Designing irrigation systems to each landscape area's specific water requirements.	◆		
	4.c.	Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.	◆		
	4.d.	Employing other comparable, equally effective, methods to reduce irrigation water runoff.	◆		
5.	**Private Roads**		◆		
	The design of private roadway drainage shall use at least one of the following				
	5.a.	Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings.			◆
	5.b.	Urban curb/swale system: street slopes to curb, periodic swale inlets drain to vegetated swale/biofilter.			◆
	5.c.	Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to storm water conveyance system.			◆
	5.d.	Other methods that are comparable and equally effective within the project.	◆		
6.	**Residential Driveways & Guest Parking**				◆
	The design of driveways and private residential parking areas shall use one at least of the following features.				
	6.a.	Design driveways with shared access, flared (single lane at street) or wheelstrips (paving only under tires); or, drain into landscaping prior to discharging to the storm water conveyance system.	◆		
	6.b.	Uncovered temporary or guest parking on private residential lots may be: paved with a permeable surface; or, designed to drain into landscaping prior to discharging to the storm water conveyance system.			◆
	6.c.	Other features which are comparable and equally effective.			◆
7.	**Dock Areas**				◆

		BMP	YES	NO	N/A
	Loading/unloading dock areas shall include the following.				
	7.a.	Cover loading dock areas, or design drainage to preclude urban run-on and runoff.			◆
	7.b.	Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.			◆
	7.c.	Other features which are comparable and equally effective.			◆
8.	**Maintenance Bays**				◆
	Maintenance bays shall include the following.				
	8.a.	Repair/maintenance bays shall be indoors; or, designed to preclude urban run-on and runoff.			◆
	8.b.	Design a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.			◆
	8.c.	Other features which are comparable and equally effective.			◆
9.	**Vehicle Wash Areas**				◆
	Priority projects that include areas for washing/steam cleaning of vehicles shall use the following.				
	9.a.	Self-contained; or covered with a roof or overhang.			◆
	9.b.	Equipped with a clarifier or other pretreatment facility.			◆
	9.c.	Properly connected to a sanitary sewer.			◆
	9.d.	Other features which are comparable and equally effective.			◆
10.	**Outdoor Processing Areas**				◆
	Outdoor process equipment operations, such as rock grinding or crushing, painting or coating, grinding or sanding, degreasing or parts cleaning, waste piles, and wastewater and solid waste treatment and disposal, and other operations determined to be a potential threat to water quality by the County shall adhere to the following requirements.				
	10.a.	Cover or enclose areas that would be the most significant source of pollutants; or, slope the area toward a dead-end sump; or, discharge to the sanitary sewer system following appropriate treatment in accordance with conditions established by the applicable sewer agency.			◆
	10.b.	Grade or berm area to prevent run-on from surrounding areas.			◆
	10.c.	Installation of storm drains in areas of equipment repair is prohibited.			◆
	10.d.	Other features which are comparable or equally effective.			◆
11.	**Equipment Wash Areas**				◆
	Outdoor equipment/accessory washing and steam cleaning activities shall be.				
	11.a.	Be self-contained; or covered with a roof or overhang.			◆
	11.b.	Be equipped with a clarifier, grease trap or other pretreatment facility, as appropriate			◆
	11.c.	Be properly connected to a sanitary sewer.			◆
	11.d.	Other features which are comparable or equally effective.			◆
12.	**Parking Areas**				◆
	The following design concepts shall be considered, and incorporated and implemented where determined applicable and feasible by the County.				
	12.a.	Where landscaping is proposed in parking areas, incorporate landscape areas into the drainage design.			◆

		BMP	YES	NO	N/A
	12.b.	Overflow parking (parking stalls provided in excess of the County's minimum parking requirements) may be constructed with permeable paving.			◆
	12.c.	Other design concepts that are comparable and equally effective.			◆
13.	**Fueling Area**				◆
	Non-retail fuel dispensing areas shall contain the following.				
	13.a.	Overhanging roof structure or canopy. The cover's minimum dimensions must be equal to or greater than the area within the grade break. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area shall drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.			◆
	13.b.	Paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete shall be prohibited.			◆
	13.c.	Have an appropriate slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of urban runoff.			◆
	13.d.	At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.			◆

Please list other project specific Source Control BMPs in the following box. Write **N/A** if there are none and briefly explain.

N/A all proposed BMPs are in the checklist.

TREATMENT CONTROL

To select a structural treatment BMP using Treatment Control BMP Selection Matrix (Table 2), each priority project shall compare the list of pollutants for which the downstream receiving waters are impaired (if any), with the pollutants anticipated to be generated by the project (as identified in Table 1). Any pollutants identified by Table 1, which are also causing a Clean Water Act section 303(d) impairment of the receiving waters of the project, shall be considered primary pollutants of concern. Priority projects that are anticipated to generate a primary pollutant of concern shall select a single or combination of stormwater BMPs from Table 2, which **maximizes pollutant removal** for the particular primary pollutant(s) of concern.

Priority projects that are **not** anticipated to generate a pollutant for which the receiving water is Clean Water Act Section 303(d) impaired shall select a single or combination of stormwater BMPs from Table 2, which are effective for pollutant removal of the identified secondary pollutants of concern, consistent with the "maximum extent practicable" standard.

Table 2. Treatment Control BMP Selection Matrix

Pollutant of Concern	*Treatment Control BMP Categories*						
	Biofilters	Detention Basins	Infiltration Basins[2]	Wet Ponds or Wetlands	Drainage Inserts	Filtration	Hydrodynamic Separator Systems[3]
Sediment	M	H	H	H	L	H	M
Nutrients	L	M	M	M	L	M	L
Heavy Metals	M	M	M	H	L	H	L
Organic Compounds	U	U	U	M	L	M	L
Trash & Debris	L	H	U	H	M	H	M
Oxygen Demanding Substances	L	M	M	M	L	M	L
Bacteria	U	U	H	H	L	M	L
Oil & Grease	M	M	U	U	L	H	L
Pesticides	U	U	U	L	L	U	L

(1) Copermittees are encouraged to periodically assess the performance characteristics of many of these BMPs to update this table.
(2) Including trenches and porous pavement.
(3) Also known as hydrodynamic devices and baffle boxes.

L: Low removal efficiency:
M: Medium removal efficiency:
H: High removal efficiency:
U: Unknown removal efficiency

Sources: *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (1993), *National Stormwater Best Management Practices Database* (2001), *Guide for BMP Selection in Urban Developed Areas* (2001), *and Caltrans New Technology Report (2001).*

A Treatment BMP must address runoff from developed areas. Please provide the post-construction water quality values for the project. Label outfalls on the BMP map. Q_{WQ} is dependent on the type of treatment BMP selected for the project.

Outfall	Tributary Area (acres)	Q_{100} (cfs)	Q_{WQ} (cfs)

See Attachment E for tributary areas, Q100 and QWQ

Please check the box(s) that best describes the Treatment BMP(s) selected for this project.

Biofilters

■ Grass swale
□ Grass strip
□ Wetland vegetation swale
□ Bioretention

Vegetated swale per County of San Diego Low Impact Development Appendicies. See Attachment E for Treatment BMP Datasheet.

Detention Basins

□ Extended/dry detention basin with grass lining
□ Extended/dry detention basin with impervious lining

Infiltration Basins
☐ Infiltration basin
☐ Infiltration trench
☐ Porous asphalt
☐ Porous concrete
☐ Porous modular concrete block
Wet Ponds or Wetlands
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
Drainage Inserts (See note below)
☐ Oil/Water separator
■ Catch basin insert See Attachment E for Treatment BMP Datasheet.
☐ Storm drain inserts
☐ Catch basin screens
Filtration
☐ Media filtration
☐ Sand filtration
Hydrodynamic Separator Systems
☐ Swirl Concentrator
☐ Cyclone Separator
☐ Baffle Separator
☐ Gross Solids Removal Device
☐ Linear Radial Device

Note: Catch basin inserts and storm drain inserts are excluded from use on County maintained right-of-way and easements.

Include Treatment Datasheet as Attachment E. The datasheet should include the following:	**COMPLETED**	**NO**
1. Description of how treatment BMP was designed. Provide a description for each type of treatment BMP.	◆	
2. Engineering calculations for the BMP(s)	◆	

Please describe why the selected treatment BMP(s) was selected for this project. For projects utilizing a low performing BMP, please provide a detailed explanation and justification.

Vegetated swales at on individual lots, minimum of 100 feet long, will treat runoff from a 24-hour 85th percentile storm event.

MAINTENANCE

Please check the box that best describes the maintenance mechanism(s) for this project.

CATEGORY	SELECTED	
	YES	NO
First	◆	
Second		◆
Third		◆
Fourth		◆

Please briefly describe the long-term fiscal resources for the selected maintenance mechanism(s).

The maintenance mechanism of First Category is required for grading of 1505 York Drive. No funding source is necessary.

ATTACHMENTS

Please include the following attachments.

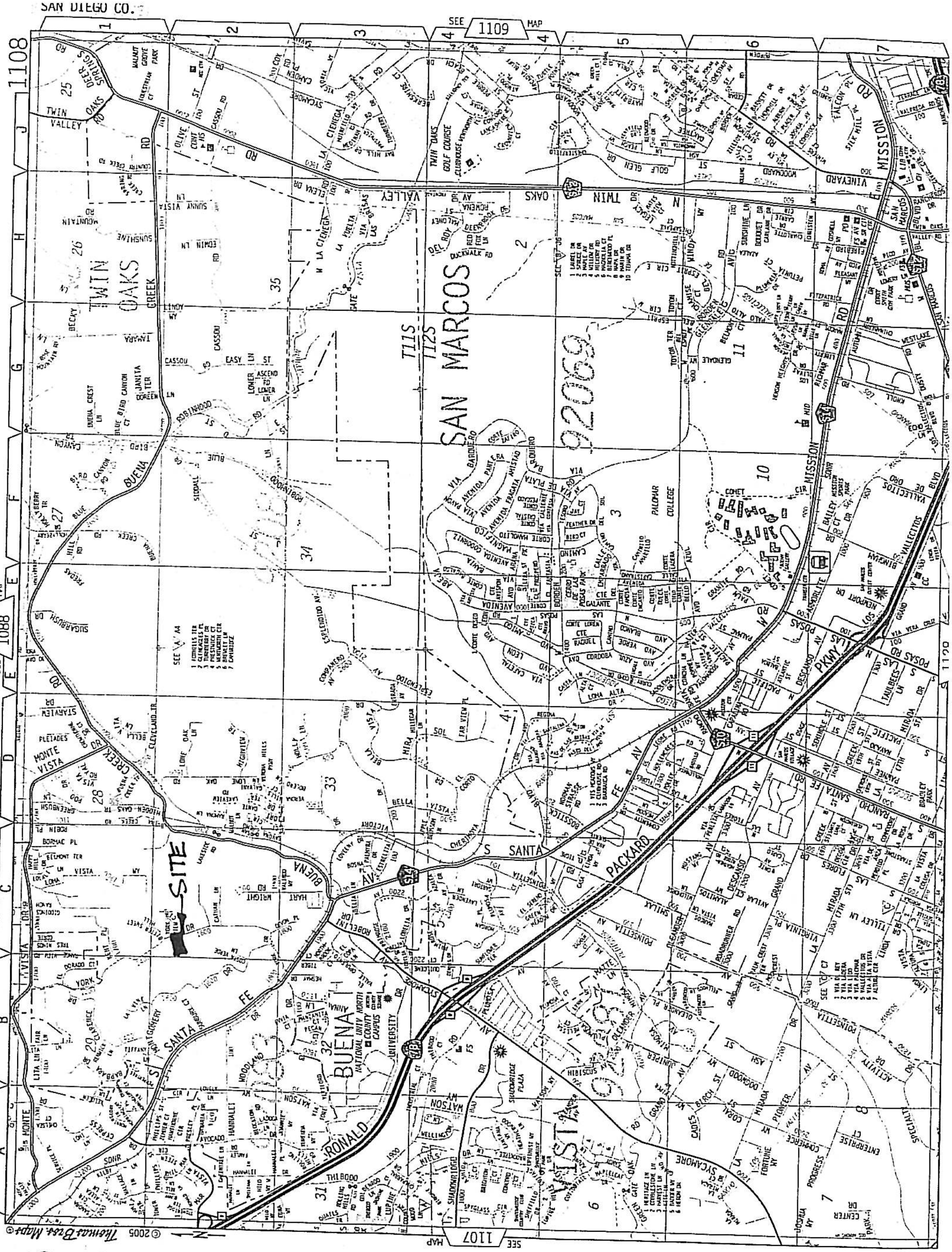
ATTACHMENT		COMPLETED	N/A
A	Project Location Map	◆	
B	Site Map	◆	
C	Relevant Monitoring Data		◆
D	Treatment BMP Location Map	◆	
E	Treatment BMP Datasheets	◆	
F	Operation and Maintenance Program for Treatment BMPs	◆	
G	Engineer's Certification Sheet	◆	

Note: Attachments A and B may be combined.

ATTACHMENT A

LOCATION MAP

SAN DIEGO CO.


1108
SEE 1109 MAP
SEE 1088 MAP
SEE 1107 MAP
SAN MARCOS
92069
TWIN OAKS
PALOMAR COLLEGE
SITE
BUENA
VISTA
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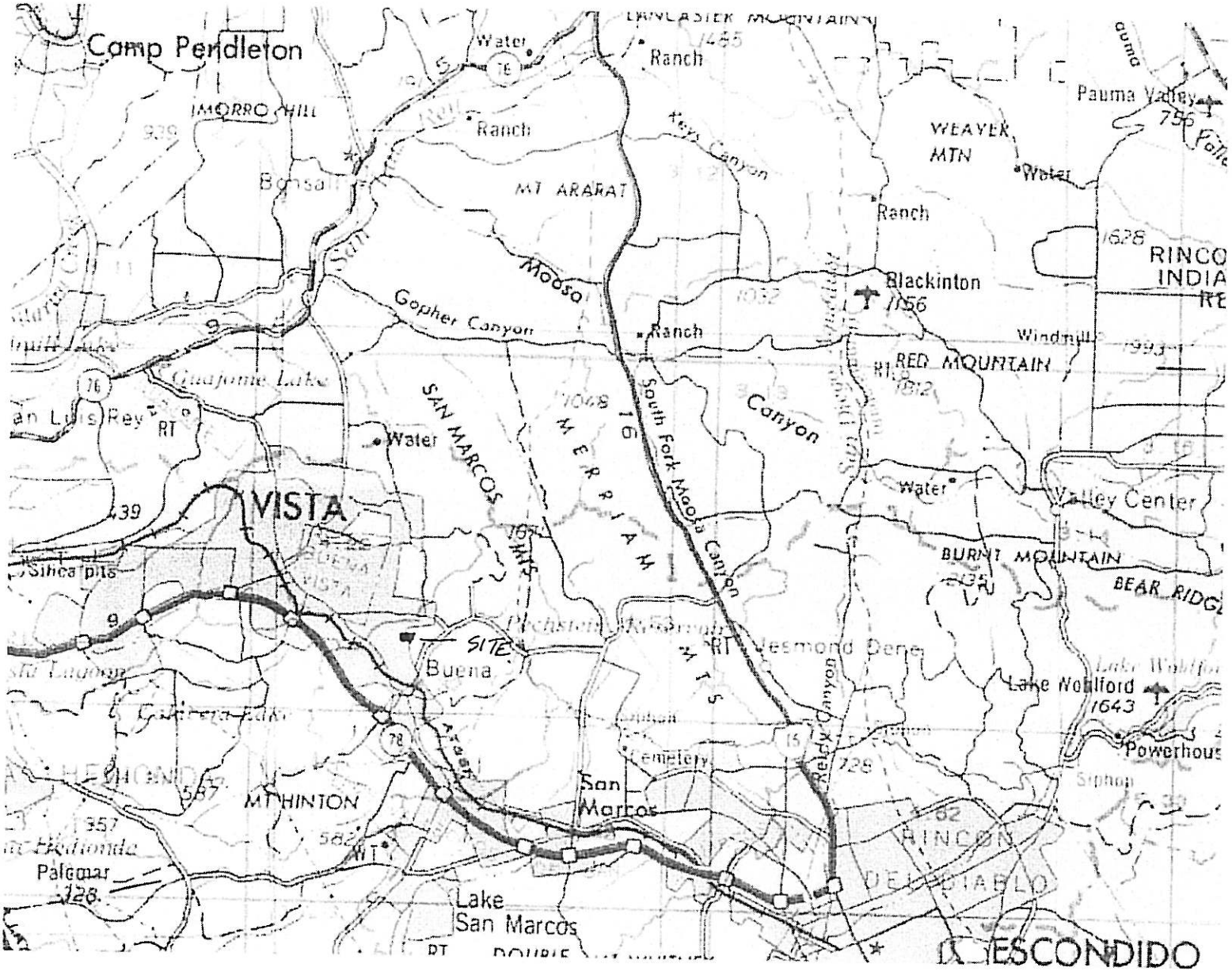
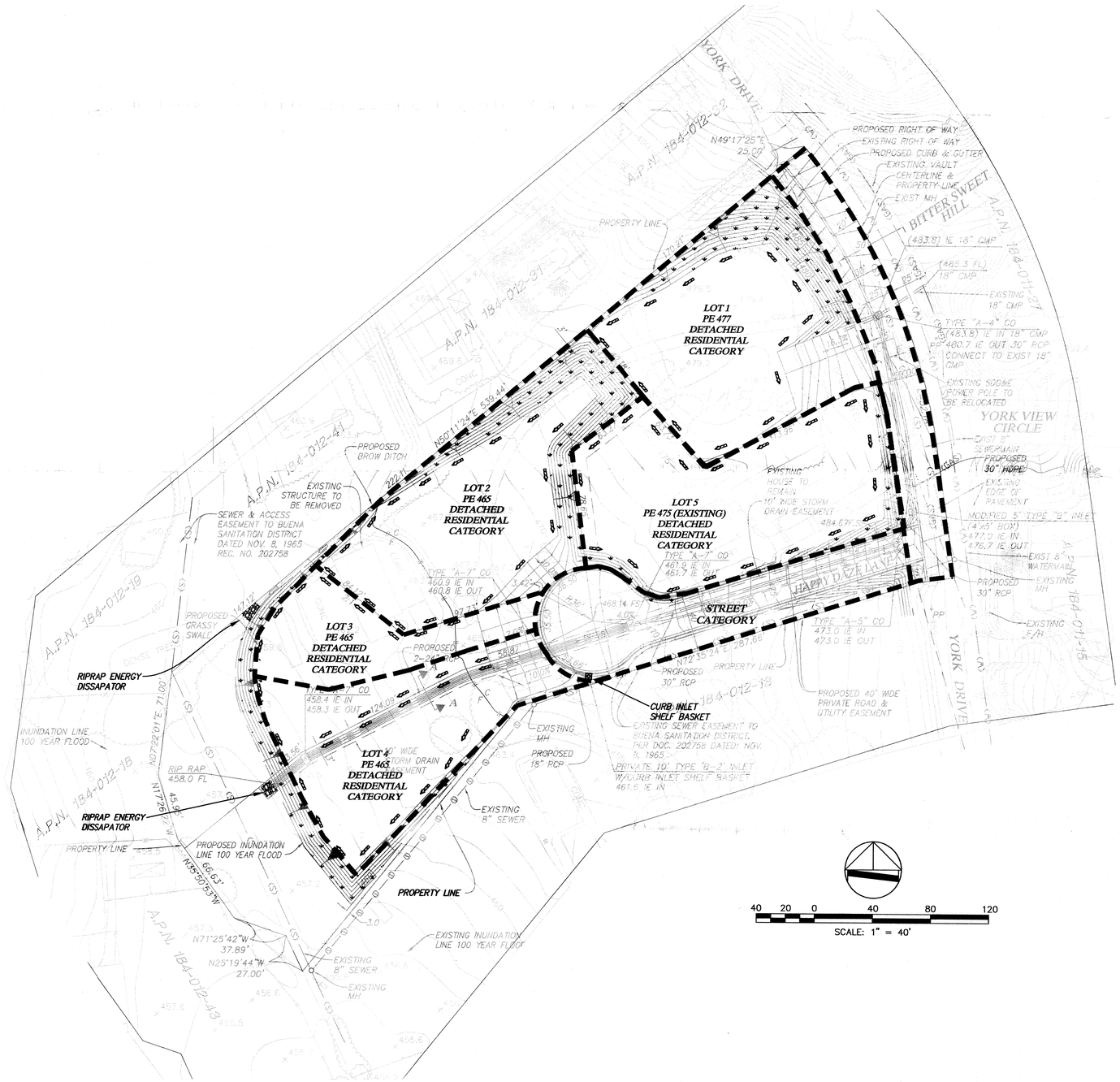

Camp Pendleton
IMORRO HILL
Bonsall
Water
Ranch
MT ARARAT
Gopher Canyon
Moosa
Ranch
Blackinton
1156
WEAVER MTN
Water
Ranch
Pauma Valley
756
RINCO
INDIA
1628
RED MOUNTAIN
Windmill
Canyon
Water
Valley Center
BURNT MOUNTAIN
BEAR RIDG
SAN MARCOS
MERRIAM
16 MI
South Fork Moosa Canyon
VISTA
Silica pits
SITE
Buena
Desmond Dene
Lake Wohlford
1643
Powerhouse
Cemetery
San Marcos
MT HINTON
Palomar
Lake San Marcos
RINCON
DEL DIABLO
ESCONDIDO

904.32

ATTACHMENT B

PROJECT SITE MAP

STORM WATER MANAGEMENT PLAN
1505 YORK DRIVE
COUNTY OF SAN DIEGO TRACT NO. 5443 RPL 2



POST-DEVELOPMENT BMPS

SITE DESIGN BMPS

THE PROJECT IS DESIGNED TO MINIMIZE THE USE OF IMPERVIOUS AREAS. STREET AND DRIVEWAYS HAVE BEEN DESIGNED TO MEET THE MINIMUM WIDTH. LANDSCAPING OF THE SLOPES AND COMMON AREAS ARE INCORPORATED INTO THE PLANS. THE GOAL IS TO ACHIEVE PLANT ESTABLISHMENT EXPEDITIOUSLY TO REDUCE EROSION. THE IRRIGATION SYSTEM FOR THESE LANDSCAPED AREAS WILL BE MONITORED TO REDUCE OVER IRRIGATION. ALSO, RIP RAP ENERGY DISSIPATORS WILL BE PLACED AT STORM DRAIN AND BROW DITCH OUTLETS TO REDUCED EXIT VELOCITIES.

SOURCE CONTROL BMPS

SOURCE CONTROL BMPS WILL CONSIST OF MEASURES TO PREVENT POLLUTED RUNOFF.
THE DEVELOPER WILL HAVE AVAILABLE AND DISTRIBUTE A SET OF BROCHURES DEVELOPED BY THE COUNTY OF SAN DIEGO'S ENVIRONMENTAL HEALTH DEPARTMENT FOR EACH OF THE HOMEOWNERS. THESE WILL INCLUDE THE FOLLOWING: STORMWATER RUNOFF POLLUTION FACT SHEET; STORMWATER RUNOFF POLLUTION PREVENTION TIP FOR HOMEOWNERS; STORMWATER POLLUTION PREVENTION YARD WORK (LANDSCAPE, GARDENING, PEST CONTROL); STORMWATER POLLUTION PREVENTION PET WASTE; AND STORMWATER BMP SWIMMING POOL AND SPA CLEANING.

USE EFFICIENT IRRIGATION SYSTEM AND LANDSCAPE DESIGN.

DESIGN DRIVEWAYS TO DRAIN INTO LANDSCAPING PRIOR TO DISCHARGING TO THE STORM WATER CONVEYANCE SYSTEM.

HILLSIDE AREAS THAT ARE DISTURBED BY PROJECT DEVELOPMENT SHALL BE LANDSCAPED WITH DEEP-ROOTED, DROUGHT TOLERANT PLANT SPECIES SELECTED FOR EROSION CONTROL, SATISFACTORY TO THE COUNTY.

DRIVEWAYS AND STREET WILL HAVE PERIODIC OPENINGS SO THAT THE RUNOFF MAY BE RELEASED AT A LOWER VOLUME AND FILTER THROUGH LANDSCAPING BEFORE ENTERING INTO NATURAL DRAINAGE.

TREATMENT CONTROL BMPS

CURB INLET SHELF BASKET

LOW IMPACT DEVELOPMENT

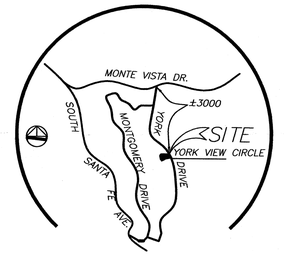
1. MINIMIZE DISTURBANCE TO NATURAL DRAINAGES
   - A. SET-BACK DEVELOPMENT ENVELOPE FROM DRAINAGES
     - RESTRICT HEAVY CONSTRUCTION EQUIPMENT ACCESS TO PLANNED GREEN/OPEN SPACE AREAS
2. MINIMIZE AND DISCONNECT IMPERVIOUS SURFACES
   - B. CLUSTERED LOT DESIGN

LOW IMPACT DEVELOPMENT TREATMENT CONTROL BMPS

GRASSY SWALE

LEGEND

- PROPOSED LANDSCAPE SLOPE
- RIP-RAP ENERGY DISSAPATOR
- GRASSY SWALE - LID TREATMENT CONTROL BMP
- CURB INLET SHELF BASKET - TREATMENT CONTROL BMP
- BASIN BOUNDARY FOR BMP
- STREET CATEGORY - LAND USE TYPE CATEGORY



VICINITY MAP
NO SCALE
TB 1108 C-2

STORM WATER MANAGEMENT PLAN

bHA, Inc.
land planning, civil engineering, surveying
5115 AVENIDA ENCINAS
SUITE "L"
CARLSBAD, CA. 92008-4387
(760) 931-8700

K:\Land Projects 3\757-1019-400\dwg\HYDROLOGY\757-STORMWATER-MGMT.dwg 10/28/2008 1:07:56 PM PDT

ATTACHMENT C

RELEVANT MONITORING DATA

*(**NOTE:** PROVIDE RELEVANT WATER QUALITY MONITORING DATA IF AVAILABLE.)*

THERE IS NO RELEVANT MONITORING DATA AVAILABLE

ATTACHMENT D

TREATMENT BMP LOCATION MAP

SEE PROJECT SITE MAP IN ATTACHMENT B

ATTACHMENT E

TREATMENT BMP DATASHEET

*(**NOTE:** POSSIBLE SOURCE FOR DATASHEETS CAN BE FOUND AT WWW.CABMPHANDBOOKS.COM. INCLUDE ENGINEERING CALCULATIONS FOR SIZING THE TREATMENT BMP.)*

LOW IMPACT DEVELOPMENT

Low Impact Development (LID) focuses on minimizing the impervious surfaces and promoting infiltration and evaporation of runoff before it can leave the project. The County of San Diego has developed a Low Impact Development Handbook and Appendices to provide Integrated Management Practices (IMPs) to mimic the existing site's natural hydrological patterns. A grassy swale similar to the vegetated swale presented in Fact Sheet 4 of the LID Appendices has been selected as the IMP to treat runoff from individual lots for this project.

Grassy Swale Characteristics:

- Swales will collect, convey, and filter site runoff and remove pollutants of concern.
- Swales will also convey the 100-year flow rate.
- Swales will also serve to delay runoff peaks by reducing flow velocities.
- The grade of the grassy swale is a minimum of 1.0%.

See calculations for grassy swales following this sheet. The typical grassy swale shown on the Project Site Map will treat runoff for individual lots, The exception is the wider grassy swale shown on Lot 4 which will convey the runoff from Happy Daze Lane if the sump curb inlet becomes clogged. See Project Site Map for details.

	Detention	Infiltration Practices			Filtration Practices						Reuse
Site Features and Design Objectives	Extended Detention Pond	Infil-tration Trench	Infil-tration Basin	Dry Well	Vegetated/ Rock Swale	Filter Strip	Sand Filter	Bio-retention system	Down-spout to Swale	Vegetated Roof and Walls	Cisterns and Rain Barrels
Clayey native soils	✓				✓	✓	✓	✓	✓	✓	✓
Permeable native soils	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Very steep slopes									✓	✓	
Shallow groundwater	✓				✓	✓	✓	✓	✓	✓	✓
Avoid saturation subsurface soils									✓	✓	
Connect to roof downspouts				✓	✓				✓		✓
Parking lots/ island medians					✓	✓	✓	✓			
Sites with extensive landscaping	✓		✓		✓	✓		✓			✓
Densely developed sites with limited space/landscape		✓		✓		✓	✓		✓	✓	✓
Fit BMPs into landscape and setback areas		✓			✓	✓	✓	✓			✓
Make drainage a design feature					✓	✓		✓			✓
Convey as well as treat stormwater					✓	✓			✓		

Adapted from Contra Costa's Stormwater C.3 Guidebook (2006).

85TH PERCENTILE STORMWATER RUNOFF PROJECT OUTFALLS

1505 YORK DRIVE
COUNTY OF SAN DIEGO

Q_{WQ}=CIA

Where:

Q_{WQ} = Flow rate per cubic feet (cfs)

C = weighted runoff coefficient of drainage area

I_{WQ} = Rainfall intensity in inches per hour (0.2 in\hr)

A = Drainage area (acres)

OUTFALL NODE	C	I_{WQ} (in\hr)	A (acres)	Q_{WQ} (cfs)	I_{100} (in\hr)	Q_{100} (cfs)
4	0.38	0.2	1.2	**0.10**	**see hydrology calculations**	**3.1**
16	0.48	0.2	1.2	**0.20**		**4.8**

85TH PERCENTILE STORMWATER RUNOFF INDIVIDUAL LOTS

1505 YORK DRIVE
COUNTY OF SAN DIEGO

Q_{WQ}=CIA

Where:

Q_{WQ} = Flow rate per cubic feet (cfs)

C = weighted runoff coefficient of drainage area

I = Rainfall intensity in inches per hour (0.2 in\hr)

A = Drainage area (acres)

LOT	C	I_{WQ} (in\hr)	A (acres)	Q_{WQ} (cfs)	I_{100} (in\hr)	Q_{100} (cfs)
1	0.38	0.2	0.49	**0.04**	6.4	**1.18**
2	0.38	0.2	0.48	**0.04**	6.4	**1.16**
3	0.38	0.2	0.29	**0.02**	6.4	**0.70**
4	0.38	0.2	0.27	**0.02**	6.4	**0.66**
5	0.38	0.2	0.50	**0.04**	6.4	**1.22**

85TH PERCENTILE STORMWATER RUNOFF CATCH BASIN

1505 YORK DRIVE
COUNTY OF SAN DIEGO

Q_{WQ}=CIA

Where:

Q_{WQ} = Flow rate per cubic feet (cfs)

C = weighted runoff coefficient of drainage area

I = Rainfall intensity in inches per hour (0.2 in\hr)

A = Drainage area (acres)

Catch Basin	C	I_{WQ} (in\hr)	A (acres)	Q_{WQ} (cfs)	I_{100} (in\hr)	Q_{100} (cfs)
NODE 12.8	0.54	0.2	0.8	**0.09**	**9.20**	**3.97**

```
**************************************************************************
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    Ver. 15.0  Release Date: 04/01/2008  License ID 1459

                    Analysis prepared by:

                          BHA INC.
                  5115 AVENDIA ENCINAS, SUITE L
                       CARLSBAD, CA 92008
                        (760) 931-8700

--------------------------------------------------------------------------
 TIME/DATE OF STUDY: 09:12 10/29/2008
==========================================================================
 Problem Descriptions:
  TYPICAL GRASSY SWALE - LID TREATMENT CONTROL BMP


**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =    6.00
            Z2(HORIZONTAL/VERTICAL) =    6.00
    BASEWIDTH(FEET) =     0.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.010000
    UNIFORM FLOW(CFS) =         0.02
    MANNINGS FRICTION FACTOR = 0.2200
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   0.16
    FLOW TOP-WIDTH(FEET) =         1.95
    FLOW AREA(SQUARE FEET) =           0.16
    HYDRAULIC DEPTH(FEET) =     0.08
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     0.13
    UNIFORM FROUDE NUMBER =    0.078
    PRESSURE + MOMENTUM(POUNDS) =             0.54
    AVERAGED VELOCITY HEAD(FEET) =      0.000
    SPECIFIC ENERGY(FEET) =      0.162
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =          0.70
    CRITICAL FLOW AREA(SQUARE FEET) =            0.02
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.03
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     0.98
    CRITICAL DEPTH(FEET) =     0.06
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =             0.06
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      0.015
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.073
==========================================================================

    MINIMUM LENGTH FOR 5 MINUTE RESIDENCE TIME = 0.13FT/S * 60S/MIN * 5MIN
                                               = 39FT
```

```
**************************************************************************
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                          Analysis prepared by:

                                BHA INC.
                          5115 AVENDIA ENCINAS, SUITE L
                               CARLSBAD, CA 92008

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 12:28 03/25/2008
==========================================================================
 Problem Descriptions:
  TYPICAL GRASSY SWALE - Q100

**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =     6.00
            Z2(HORIZONTAL/VERTICAL) =     6.00
    BASEWIDTH(FEET) =      0.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.010000
    UNIFORM FLOW(CFS) =         0.61
    MANNINGS FRICTION FACTOR = 0.0220
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   0.25
    FLOW TOP-WIDTH(FEET) =          2.95
    FLOW AREA(SQUARE FEET) =             0.36
    HYDRAULIC DEPTH(FEET) =      0.12
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      1.68
    UNIFORM FROUDE NUMBER =    0.844
    PRESSURE + MOMENTUM(POUNDS) =              3.84
    AVERAGED VELOCITY HEAD(FEET) =       0.044
    SPECIFIC ENERGY(FEET) =       0.290
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =          2.76
    CRITICAL FLOW AREA(SQUARE FEET) =             0.32
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.12
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =      1.92
    CRITICAL DEPTH(FEET) =      0.23
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =             3.79
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       0.057
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       0.287
==========================================================================
```

```
**************************************************************************
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            Ver. 14.0  Release Date: 06/01/2007  License ID 1459

                          Analysis prepared by:

                                BHA INC.
                          5115 AVENDIA ENCINAS, SUITE L
                               CARLSBAD, CA 92008

--------------------------------------------------------------------------
  TIME/DATE OF STUDY: 15:55 03/25/2008
==========================================================================
 Problem Descriptions:
  GRASSY SWALE FOR LOT 4/ FLOODING DUE TO CLOGGED CURB INLET

**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =    3.00
            Z2(HORIZONTAL/VERTICAL) =    3.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.010000
    UNIFORM FLOW(CFS) =         4.60
    MANNINGS FRICTION FACTOR = 0.0220
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   0.44
    FLOW TOP-WIDTH(FEET) =          4.67
    FLOW AREA(SQUARE FEET) =            1.48
    HYDRAULIC DEPTH(FEET) =     0.32
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.11
    UNIFORM FROUDE NUMBER =    0.971
    PRESSURE + MOMENTUM(POUNDS) =           45.48
    AVERAGED VELOCITY HEAD(FEET) =      0.150
    SPECIFIC ENERGY(FEET) =      0.594
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         4.62
    CRITICAL FLOW AREA(SQUARE FEET) =           1.45
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.31
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.17
    CRITICAL DEPTH(FEET) =     0.44
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           45.46
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      0.156
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.594
==========================================================================
```
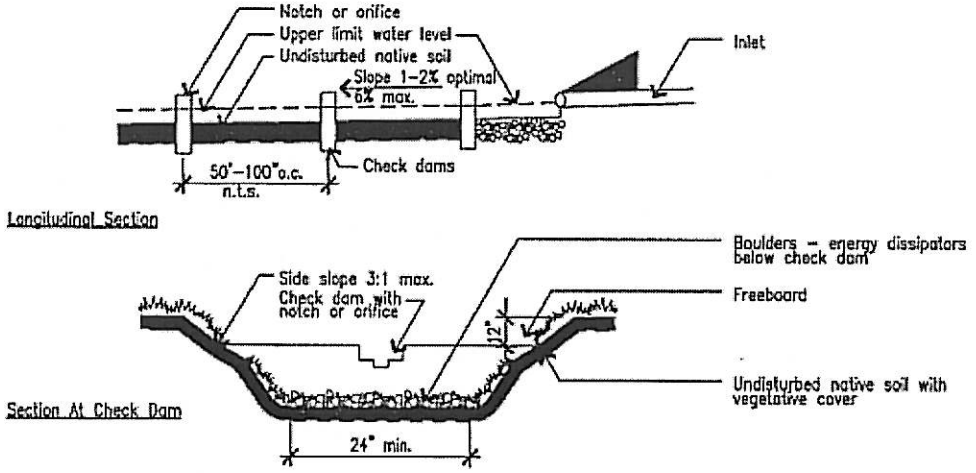

Fact Sheet 4. Vegetated Swale / Rock Swale



Conditions, dimensions, and materials shown are typical. Modifications may be required for proper application, consult qualified professional.

Vegetated / rock swales are vegetated or rock lined earthen channels that collect, convey, and filter site water runoff and remove pollutants. Swales are an alternative to lined channels and pipes; configuration and setting are unique to each site.

CHARACTERISTICS

- If properly designed and maintained, swales can last for at least 50 years.
- Can be used in all soil types, natural or amended.
- When swales are not holding water, they appear as a typical landscaped area.
- Water is filtered by vegetation/rocks and pollutants are removed by infiltration into the subsurface of the soil.
- Swales also serve to delay runoff peaks by reducing flow velocities.

APPLICATION

- Swales are most effective in removing coarse to medium sized sediments.
- Parking lot medians, perimeters of impervious pavements.
- Street and highway medians, edges (in lieu of curb and gutter, where appropriate).
- In combination with constructed treatment systems or sand filters.

DESIGN

- Vegetation of each swale is unique to the setting, function, climate, geology, and character of each site and climatic condition.
- Can be designed with natural or amended soils, depending on the infiltration rate provided by the natural condition versus the rate needed to reduce surface runoff.
- Grass swales move water more quickly than vegetated swales. A grass swale is planted with salt grass; a vegetated swale is planted with bunch grass, shrubs or trees.
- Rocks, gravel, boulders, and/or cobbles help slow peak velocity, allow sedimentation, and add aesthetic value.

- Pollutant removal effectiveness can be maximized by increasing residence time of water in swale using weirs or check dams.
- Swales are often used as an alternative to curbs and gutters along roadways, but can also be used to convey stormwater flows in recreation areas and parking lots.
- Calculations should also be provided proving the swale capable of safely conveying the 100-year flow to the swale without flooding adjacent property or infrastructure.
- See County of San Diego Drainage Design Manual for design criteria. (section 5.5) http://www.sdcounty.ca.gov/dpw/docs/hydrologymanual.pdf

MAINTENANCE

- Swale maintenance includes mowing and removing clippings and litter. Vegetated swales may require additional maintenance of plants.
- Periodically remove sediment accumulation at top of bank, in swale bed, or behind check dams.
- Monitor for erosion and reseed grass or replace plants, erosion control netting and mulch as necessary. Fertilize and replace vegetation well in advance of rainy season to minimize water quality degradation.
- Regular inspections and maintenance is required during the establishment period.

LIMITATIONS

- Only suitable for grades between 1% and 6%; when greater than 2.5% should be paired with weir or check dam.
- "Turf" swales will commonly require irrigation and may not meet State water conservation goals.
- Irrigated vegetation is not appropriate in certain sites. Xeriscape techniques, natural stone and rock linings should be used as an alternative to turf.
- Wider road corridors may be required to incorporate swales.
- Contributing drainage areas should be sized to meet the stormwater management objective given the amount of flow that will be produced.
- When contributing flow could cause formation of low-flow channel, channel dividers must be constructed to direct flow and prevent erosion.

ECONOMICS

- Estimated grass swale construction cost per linear foot $4.50-$8.50 (from seed) to $15-20 (from sod), compare to $2 per inch of diameter underground pipe e.g., a 12" pipe would cost $24 per linear foot).
- $0.75 annual maintenance cost per linear foot

REFERENCES

- CALTRANS – Storm Water Handbook (cabmphandbooks.com)
- For additional information pertaining to Swales, see the works cited in the San Diego County LID Literature Index.

Vegetated Swale

TC-30

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

CASQA

CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
	Removal Efficiencies (% Removal)						
Study	TSS	TP	TN	NO_3	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately $0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately $0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c]	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	–	–	–	–	–	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	–	–	–	–	–	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right) \times$ swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	\$0.85 / 1,000 ft²/ mowing	\$0.14 / linear foot	\$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	\$9.00 / 1,000 ft²/ year	\$0.18 / linear foot	\$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	\$0.10 / linear foot / year	\$0.10 / linear foot	\$0.10 / linear foot	–
Grass Reseeding with Mulch and Fertilizer	\$0.30 / yd²	\$0.01 / linear foot	\$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	\$0.15 / linear foot / year, plus \$25 / inspection	\$0.15 / linear foot	\$0.15 / linear foot	Inspect four times per year
Total	--	**\$0.58 / linear foot**	**\$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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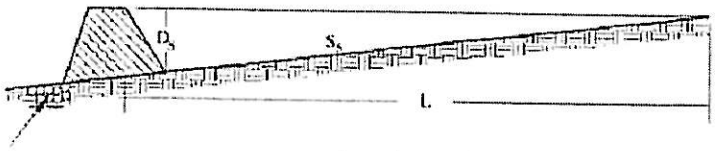
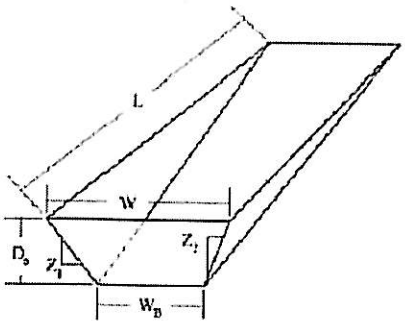


Provide for scour protection.

(a) Cross section of swale with check dam.



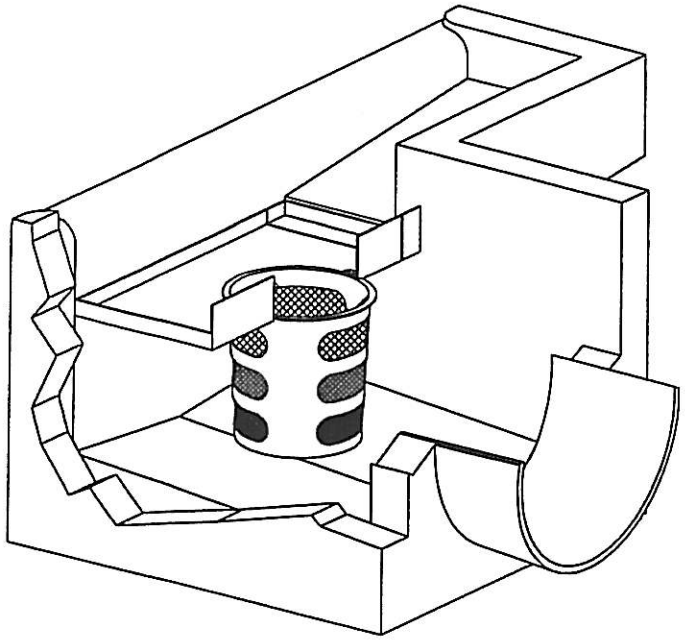
(b) Dimensional view of swale impoundment area.

Notation:

L = Length of swale impoundment area per check dam (ft)
D_s = Depth of check dam (ft)
S_s = Bottom slope of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
Z_{s1} = Ratio of horizontal to vertical change in swale side slope (ft/ft)

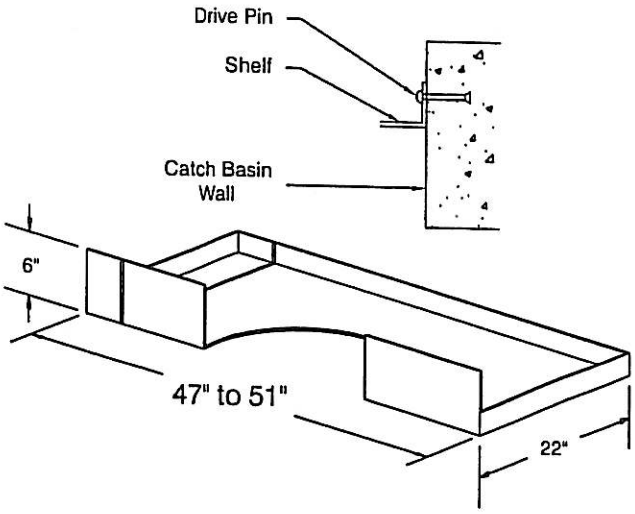
The California Curb Shelf Basket Water Cleansing System
HIGH CAPACITY CANISTER

By: Suntree Technologies Inc. - (321) 799-0001
www.suntreetech.com



The California Curb Shelf Basket Shelf Water Cleaning System

Figure 1



Details of Shelf System (Dimensions will vary)

Figure 2

ROUND CANISTER IN SQUARE BASIN

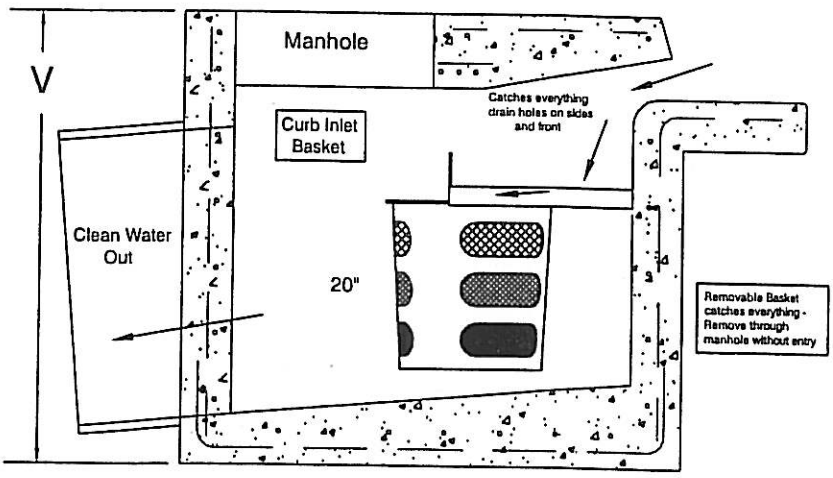


Figure 3

Patent Pending

FLOW RATE				
$Q = SO * c_d * A\sqrt{2 * g * h} / 1728$; $c_d = \frac{\text{Coefficient of}}{\text{Discharge}} = .67$				
	SO	A (in^2)	h (in)	Q ($\frac{ft^3}{s}$)
Top - Side	1	135.22	5.50	3.42
Center - Side	.62	130.36	11.50	2.95
Bottom - Side	.56	125.50	17.50	3.17
Bottom	.68	63.14	20.81	2.11
TOTAL				11.65

NOTES:

1. Shelf system provides for entire coverage of inlet opening so to divert all flow to basket.
2. Shelf system manufactured from marine grade fiberglass, gel coated for UV protection.
3. Shelf system attched to catch basin with non corrosive hardware.
4. Filtration Basket structure manufactured of marine grade fiberglass, gel coated for UV protection.
5. Filtration Basket fine screen and coarse containment screen manufactured from stainless steel.
6. Filtration Basket holds boom of absorbent media to capture hydrocarbons. Boom is easily replaced without removing mounting hardware.
7. Filtration Basket location is directly under manhole access for easy maintenance.

GRATE INLET SKIMMER BOXES FOR DEBRIS, SEDIMENT, AND OIL & GREASE REMOVAL

Reedy Creek Improvement District
Planning & Engineering Department
Eddie Snell, Compliance Specialist

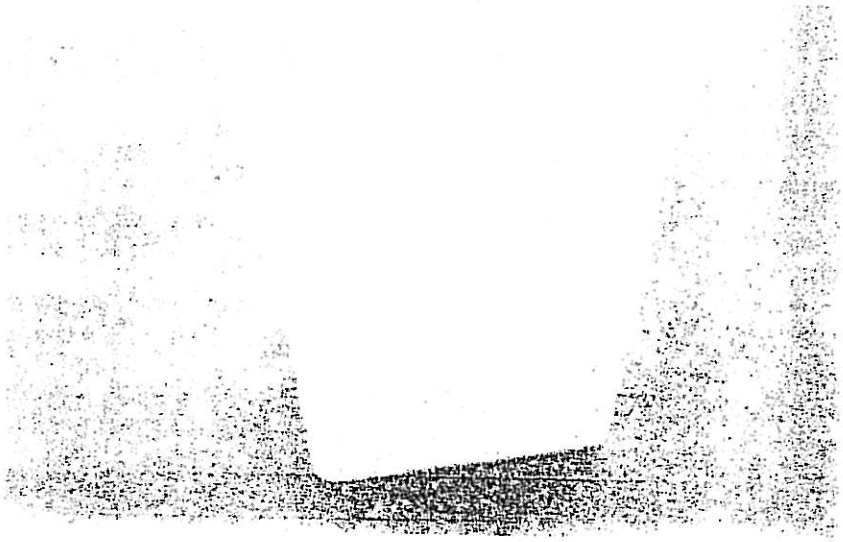
Stormwater is now recognized as the leading source of pollution to our remaining natural water bodies in the United States. Development and urbanization have removed most of the natural filtration and sediment trapping systems provided by the environment. Current development must address this need through the implementation of stormwater treatments systems in the project design. Most of these systems perform reasonably well, if properly designed, constructed, and maintained.

Retrofit of older urban areas lacking these modern stormwater systems is a continually expensive challenge. The Downtown Disney complex, formerly the Lake Buena Vista Shopping Village, has several drainage basins with 1970's stormwater systems. These older systems discharge directly into the adjacent drainage canal with no pollutant treatment. Over time the accumulation of sediments, nutrients, intensive development, and recreational/entertainment pressures are contributing to water quality degradation.

Whenever new development or redevelopment occurs, the stormwater system is brought to current code/permit requirements. In the interim, several areas are in need for rapid, effective, and economical improvement in the quality of its stormwater discharge.

Suntree Technologies Incorporated, located in Cape Canaveral, FL, manufactures stormwater grate inlet skimmer boxes. They are made of a high quality fiberglass frame, with stainless steel filter screens backed by heavy-duty aluminum grating. Each unit is custom made to accommodate various inlet sizes. A hydrocarbon absorption boom is attached to the top of the skimmer box for petroleum, oil, and grease removal.

These devices fit below the grate and catch sediment, debris, and petroleums, oils & greases. Clean-out, maintenance, and performance reporting is provided by Suntree on a scheduled basis.



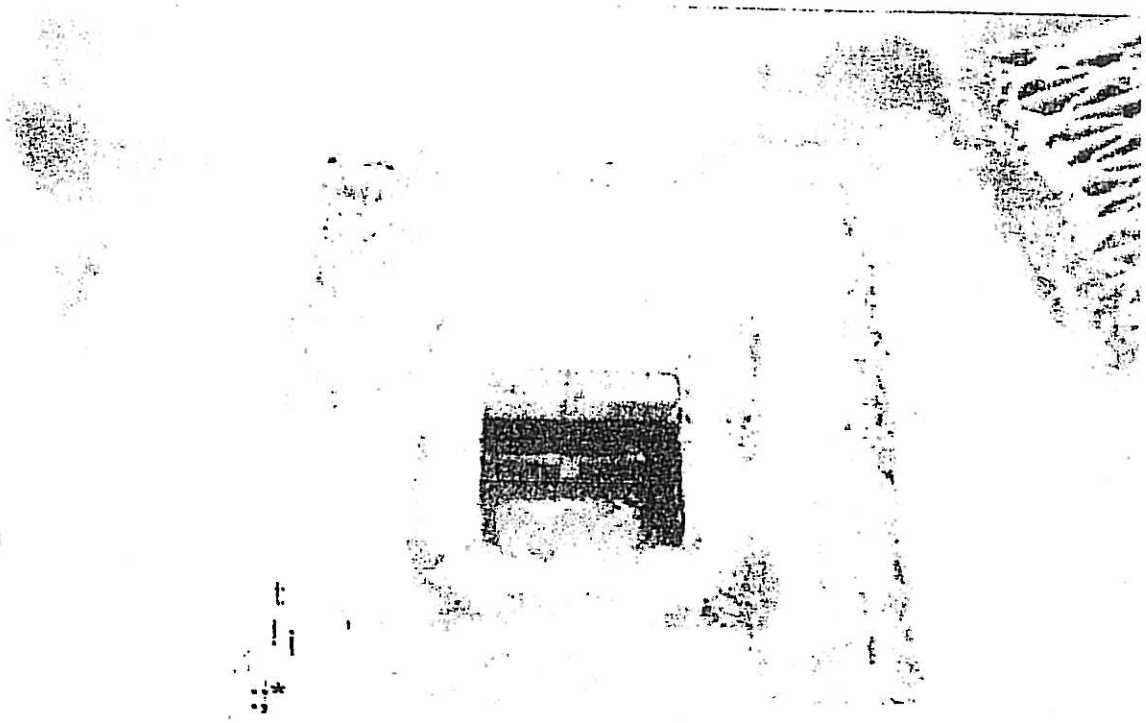
The Reedy Creek Improvement District (RCID) selected six (6) test sites in the Lake Buena Vista area to evaluate the performance of these units. One unit was placed in a curb inlet along Hotel Plaza Boulevard to trap landscape leaf litter, sediment, and oil & grease from a high use roadway. Three (3) units were placed in the backstage service area of the Rain Forest Cafe. Two (2) units were placed in the backstage service area of the McDonald's restaurant and Legos merchandise shop.

After several field meetings, during which Suntree took extensive measurements, photos, and other documentation of each stormwater drain, the Grate Inlet Skimmer Boxes were manufactured and delivered for installation. All units were installed without mishap approximately two weeks before the 1999 Christmas holiday season. The target time period for particle catchment was one month. Mr. Henry and Tom Happel, Suntree Technologies, visited each site several times during the month to ensure that debris would not fill the units too soon.

On January 25,2000, Suntree serviced the six units. At each site, the material captured in the skimmer boxes was removed, measured, weighed, visually identified, photographed, and recorded. Some units were slightly field modified for optimum performance. All

the six sites. The composition of debris varied considerably.

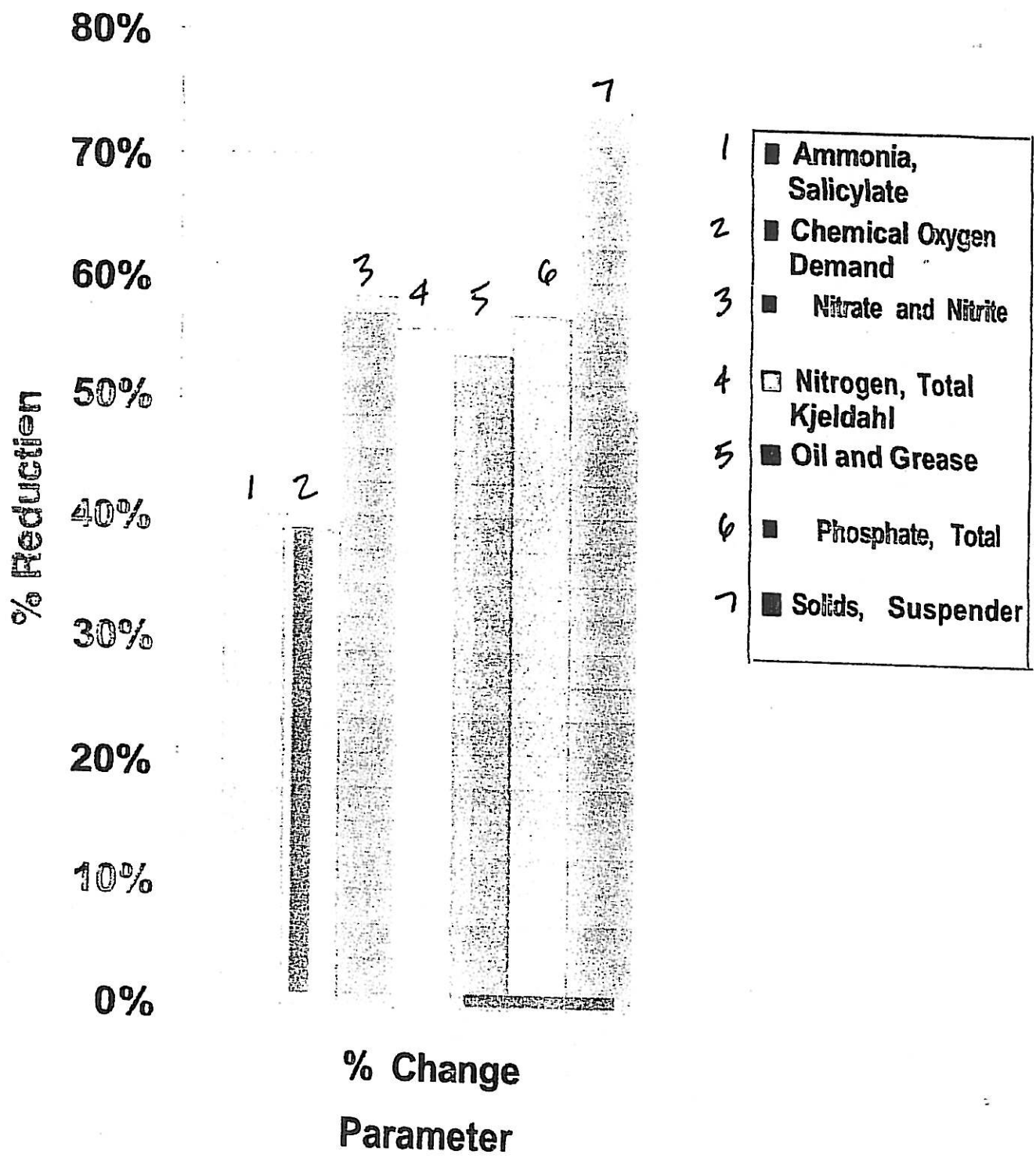
The Hotel Plaza (roadway) site was 90% leaf litter and 10% sediment. The Rain Forest Cafe sites ran in opposition as you got close to the lake. First inlet was about 50% leaf er and cigarette butts and 50% sediment. The middle inlet was 60 % sediment and 30 % leaf litter (10% miscellaneous). The inlet closest to the lake was 95% sediment and 5% leaf litter. The two sites at the McDonalds/Legos area were similar to each other. The site closest to the lake was 95% sediment and 5% leaf litter. The site closest to the entrance gate was 98% litter sediment and 2% leaf litter.



This composition is indicative of the human activities and drainage flow patterns of that site. Backstage areas in the Walt Disney World Resort receive an artificial rain event each night during cleaning operations. This washes a continual flow over the impervious site, washing all materials into the stormwater system.

Municipalities in Brevard, Volusia and Dade counties have successfully used inlet skimmers in Florida. RCID partnered with Walt Disney Imagineering (WDI) Research and Development to coordinate some basic chemical sampling for pollutant removal efficiency determination. Mr. Craig Duxbury, WDI, provided technical support and uidance for this. An ingeniously simple device was fabricated by Suntree to allow sampling of the First Flush of water going into the units and ultimately coming out of the skimmer boxes.

Pollutant Removal Efficiency



ATTACHMENT F

OPERATION AND MAINTENANCE PROGRAM FOR TREATMENT BMP

*(**NOTE:** INFORMATION REGARDING OPERATION AND MAINTENANCE CAN BE OBTAINED FROM THE FOLLOWING WEB SITE: HTTP://WWW.SDCOUNTY.CA.GOV/DPW/WATERSHEDS/LAND_DEV/SUSMP.HTML.)*

APPENDIX H Estimated O & M Costs for BMP Project

Estimated vlaues derived from Caltrans Pilot BMP Study. This spreadsheet will change as additional data becomes available.						Labor			Equipment				Materials		Total	Comments
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost	
BIOFILTER – STRIPS and SWALES																
Preventive Maintenance and Routine Inspections																
ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENTS											
Height of vegetation	Average vegetation height exceeds 12 inches, emergence of trees, or woody vegetation	Visual inspection of vegetation throughout strip/swale	Once during wet season, once during dry season.(depending on growth)	Cut vegetation to an average height of 6 inches	Remove any trees, or woody vegetation.	10	43.63	436.3	one-ton truck & hydroseeder	2	26.84	53.68	string trimmer, rake, fork, bags, safety equipment	50	539.98	
Assess adequate vegetative cover	Less than 90 percent coverage in strip invert/swale or less than 70 percent on swale side slope	Visual inspection of strip/swale. Prepare a site schematic to record location and distribution of barren or browning spots to be restored. File the schematic for assessment of persistent problems.	Assess quantity needed in May each year late wet season and late dry season.	Reseed/revegetate barren spots by Nov.		8	43.63	349.04	one-ton truck & hydroseeder	1	48.15	48.15	seed	150	547.19	
				Scarify area to be restored, to a depth of 2-inches. Restore side slope coverage with hydroseed mixture.		0	43.63	0	one-ton truck & hydroseeder	0	26.84	0			0	
				If after 2 applications (2 seasons) of reseeding/revegetating and growth is unsuccessful both times, an erosion blanket or equivalent protection will be installed over eroding areas		0	43.63	0	one-ton truck & hydroseeder	0	26.84	0	blanket	0	0	
Inspect for debris accumulation	Debris or litter present	Visual observation	During routine trashing, per Districts schedule.	Remove litter, and debris.	None	0	0	0	one-ton truck & hydroseeder	0	0	0			0	
Inspect for accumulated sediment	Sediment at or near vegetation height, channeling of flow, inhibited flow due to change in slope.	Visual observation	Annually	Remove sediment. If flow is channeled, determine cause and take corrective action. If sediment becomes deep enough to change the flow gradient, remove sediment during dry season, characterize and properly dispose of sediment, and revegetate.		16	43.63	698.08	one-ton truck & hydroseeder	1	48.15	48.15	seed, testing and disposal of sediment	300	1046.23	once every three years

APPENDIX H Estimated O & M Costs for BMP Project

Estimated vlaues derived from Caltrans Pilot BMP Study. This spreadsheet will change as additional data becomes available.

						Labor			Equipment				Materials		Total	Comments
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost	
				Notify engineer to determine if regrading is necessary. If necessary, regrade to design specification and revegetate swale/strip. If regrading is necessary, the process should start in May. Revegetate strip/swale in Nov. Target completion prior to wet season.	None	2	43.63	87.26				0			87.26	
Inspect for burrows	Burrows, holes, mounds	Visual observation	Annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.		0	0	0	one-ton truck & hydroseeder	0	26.84	0			0	
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion,emergence of trees, woody vegetation , fence damage, etc.	Visual observation	Semi-Annually, late wet season and late dry season.	Corrective action prior to wet season. Consult engineer if an immediate solution is not evident.	Remove any trees, or woody vegetation.	16	43.63	698.08	one-ton truck & hydroseeder	2	26.84	53.68			751.76	
TOTAL BIO FILTER AND SWALES						52		2268.76				203.66		500	2972.42	
BIO STRIP WITH SPREADER DITCH					Includes all the above plus the following.			0				0			0	
Inspect for standing water	Water accumulation in spreader ditch	Standing water in spreader ditch	Within 72 hours after a storm event 0.75 inches or greater.	De-water the spreader ditch to a depth of less than 0.25 inches. If sediment impedes the de-watering activity, then move or remove that portion of the sediment. Characterize and properly dispose.		3	43.63	130.89	0	0	0	0			130.89	
				De-water the spreader ditch to a depth of less than 0.25" by removing the bypass plug and allowing the water to drain into the infiltration trench. Use care to prevent sediment from discharging into the infiltration trench. Replace the bypass plug once the de-watering has been completed.		6	43.63	261.78	0	0	0	0			261.78	

APPENDIX H Estimated O & M Costs for BMP Project

Estimated vlaues derived from Caltrans Pilot BMP Study. This spreadsheet will change as additional data becomes available.						Labor			Equipment				Materials		Total	Comments
						Per. Hrs	Rate	Cost	Type	Days	rate	Cost	Item	Cost	Cost	
				At the end of the wet season, remove the bypass plug and allow the spreader ditch to drain. Use care to prevent sediment from discharging into the infiltration trench. Remove, characterize, and dispose of sediment from the spreader ditch. Replace the bypass plug before the beginning of the wet season.		2	43.63	87.26	sedan	1	21.28	21.28	testing & disposal costs	200	308.54	
TOTAL BIO STRIP WITH SPREADER DITCH						55		2399.65				203.66		500	3103.31	
CONTINUOUS DEFLECTIVE SEPARATION (CDS) UNITS																
Preventive Maintenance and Routine Inspections																
DESIGN CRITERIA,																
ROUTINE ACTIONS	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENTS											
Inspect sump for accumulation of material.																
	or							0				0			0	
	When the sump is 50% full during two consecutive monthly inspections.							0				0			0	
	or															
	Annually in May, effect cleaning within 15 days			Empty unit		72	43.63	3141.36	one-ton truck & vactor	3	198.75	596.25	testing & disposal costs	1800	5537.61	
								0				0			0	
Inspect weir box for accumulation of material.	Presence of trash and debris	Visual observation	Monthly during the wet season	Remove trash and debris while onsite conducting inspection.		0	0	0		0	0	0		0	0	Hours accounted for during inspections
Inspect for standing water. (Include with all of inspection)	Standing water in sump	Visual observation	Annually, 72 hours after target2 storm (0.75 in)	If standing water cannot be removed or remains through the wet season notify VCD.	None											
Inspect the screen for damage and to ensure that it is properly fastened.	Screen becomes clogged, damaged or loose	Visual observation	Annually before wet season.	Clean screen.	None	0	0	0	0	0	0	0	0	0	0	Hours accounted for during inspections
Inspection for structural integrity	Holes in screen, large debris, damage to housing or weir box	Visual observation	Annually or after a cleanout.	Immediately consult with engineer and manufacturer's representative to develop a course of action, effect repairs prior to the wet season.	None			0				0			0	Hours accounted for during inspections
TOTAL CDS UNITS						72		3141.36				596.25		1800	5537.61	
DRAIN INLET INSERTS – FOSSIL FILTER																

COUNTY OF SAN DIEGO TM 5443 15-Oct-07

Engineer: BHA Inc

BMP MAINTENANCE PROGRAM

BMP	Routine Action	Maintenance	Field Measurement	Frequency	Maintenance Activity
Outlet Protection	Inspect after each significant rainfall	Disturbed or missing rocks (Rip Rap). Soil erosion past protection. BMP's indicates additional protection required.	Visual inspection for rills and soil erosion past outlet protection and displaced rocks.	Inspect monthly and after each significant rainfall or construction activity in area of protection.	Reposition and replace rocks as required. If soil erosion present, extend rip-rap and reposition bags.
Curb Inlet Filter	Sediment removal	Sediment more than 1/2 height of filter body.	Visual inspection of filter body.	After each rain event.	Remove and properly dispose of sediment.
	Trash and debris removal.	Sufficient trash or debris accumulation to hinder filter performance.	Visual inspection of inlet and filter insert.	After each rain event.	Remove and properly dispose of trash and debris accumulation.
	Oil and grease	Absorbent medium dark gray or darker and saturated with oil.	Visual inspection of absorbent filter media.	After each Target 2 (0.75") rain event.	Replace absorbent media within 10 days. Characterize and properly dispose of spent media prior to wet season.
	Structural integrity of insert	Broken or damaged insert with visible rips, tears, gashes and/or fallen media.	Visual inspection of absorbent filter media.	Semi annually, May and October.	Replace insert. Contact vendor to develop preventive procedures. Effect repairs within 10 working days.
	Annual renewal of Absorbent medium.	End of wet season.	Lack of precipitation for extended period.	Annually before wet season.	Remove, characterize and properly dispose of spent media. Replace absorbent media before start of wet season.
Biofiltration Grassy Swale	Height of vegetation	Average vegetation height exceeds 12 inches, emergence of trees, or woody vegetation	Visual inspection of vegetation through out strip/swale	Once during wet season during dry season. (Depending on growth.)	Cut vegetation to an average height of 6 inches

COUNTY OF SAN DIEGO TM 5443 15-Oct-07

Engineer: BHA Inc

BMP MAINTENANCE PROGRAM

BMP	Routine Action	Maintenance	Field Measurement	Frequency	Maintenance Activity
	Assess adequate vegetative cover	Less than 90 percent coverage in strip invert/ swale or less than 70 percent on swale side slope	Visual inspection of strip/ swale. Prepare a site location schematic to record and distribution of barren or browning spots to be restored. File the schematic for assessment of persistent of problems.	Access quantity needed in May each year late wet season and late dry season Scarify area to be restored, to a depth of 2-inches. Restore side slope coverage with hydroseed mixture if after 2 applications of reseeding/ revegetating and growth is unsuccessful both times, an erosion blanket or equivalent protection will be installed over eroding areas.	Reseed/revegetate barren spots by Nov.
	Inspect for debris accumulation	Debris or litter present	Visual observation exceeds 12 inches,	During routine trashing, per District schedule (Depending on growth.)	Remove litter, and debris
	Inspection for accumulated sediment	Sediment at or near vegetation height, channeling of flow, inhibited flow due to change in slope	Visual observation	Annually	Remove litter and debris
	Inspection for accumulated sediment	Sediment at or near vegetation height, channeling of flow, inhibited flow due to change in slope	Visual observation	Annually	Remove sediment. If flow is channeled determine cause and take corrective action. If sediment becomes deep enough to change the flow gradient, remove sediment

COUNTY OF SAN DIEGO TM 5443 15-Oct-07

Engineer: BHA Inc

BMP MAINTENANCE PROGRAM

BMP	Routine Action	Maintenance	Field Measurement	Frequency	Maintenance Activity
				Notify engineer to if regrading is necessary. If necessary, regrade to design specification and revegetate swale/strip. If regrading is necessary, the process should start in May. Revegetate strip/ swale in Nov. Target completion prior to wet season.	during dry season characterize and properly dispose of sediment, and revegetate
	Inspect for burrows	Burrows, holes, mounds	Visual Observation	Annually and after vegetation trimming	Where burrows cause seepage erosion and leakage, backfill firmly.
	General maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, emergence of trees, woody vegetation fence damage, etc.	Visual observation	Semi-annually, late wet season and late dry season	Corrective action prior to wet season. Consult engineer if an immediate solution is not evident.

BMP OPERATION & MAINTENANCE COST ESTIMATE (FOR TWO YEARS)

1505 YORK DRIVE, TM 5443/ER87-08-036A
Engineer: BHA Inc

17-Oct-07

BMP ITEM	QUANTITY	UNIT	UNIT PRICE PER YEAR	ANNUAL COST	2 YEAR ANNUAL COST
Biofilter	5	EA	$2,972.42	$14,862	$29,724
Curb Inlet Filter	1	EA	$478.06	$478	$956
				Total	$30,680
				10% Contingency	$3,068
				Grand Total	**$33,748**

ATTACHMENT H

CERTIFICATION SHEET

This Stormwater Management Plan has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decision are based.

Bruce L. Rice RCE 60676 Exp. 12-31-08

Date

ATTACHMENT H

ADDENDUM

(LID CHECK LIST)

HYDROMODIFICATION DETERMINATION

The following questions provide a guide to collecting information relevant to hydromodification management issues.

Table 2

	QUESTIONS	YES	NO	Information
1.	Will the proposed project disturb 50 or more acres of land? (Including all phases of development)		X	If YES, continue to 2. If NO, go to 6.
2.	Would the project site discharge directly into channels that are concrete-lined or significantly hardened such as with rip-rap, sackcrete, etc, downstream to their outfall into bays or the ocean?			If NO, continue to 3. If YES, go to 6.
3.	Would the project site discharge directly into underground storm drains discharging directly to bays or the ocean?			If NO, continue to 4. If YES, go to 6.
4.	Would the project site discharge directly to a channel (lined or un-lined) and the combined impervious surfaces downstream from the project site to discharge at the ocean or bay are 70% or greater?			If NO, continue to 5. If YES, go to 6.
5.	Project is required to manage hydromodification impacts.			Hydromodification Management Required as described in Section 67.812 b(4) of the WPO.
6.	Project is not required to manage hydromodification impacts.		X	Hydromodification Exempt. Keep on file.

An exemption is potentially available for projects that are required (No. 5. in Table 2 above) to manage hydromodification impacts: The project proponent may conduct an independent geomorphic study to determine the project's full hydromodification impact. The study must incorporate sediment transport modeling across the range of geomorphically-significant flows and demonstrate to the County's satisfaction that the project flows and sediment reductions will not detrimentally affect the receiving water to qualify for the exemption.

LOW IMPACT DEVELOPMENT (LID)

Each numbered item below is a LID requirement of the WPO. Please check the box(s) under each number that best describes the Low Impact Development BMP(s) selected for this project.

Table 7

1. Conserve natural Areas, Soils, and Vegetation-County LID Handbook 2.2.1
☐ Preserve well draining soils (Type A or B)
☐ Preserve Significant Trees
☐ Other. Description:
☒ 1. Not feasible. State Reason: Soil is Type "D". No significant trees on-site
2. Minimize Disturbance to Natural Drainages-County LID Handbook 2.2.2
☒ Set-back development envelope from drainages
Restrict heavy construction equipment access to planned green/open space areas
☐ Other. Description:
☐ 2. Not feasible. State Reason:
3. Minimize and Disconnect Impervious Surfaces (see 5) -County LID Handbook 2.2.3
☒ Clustered Lot Design
☒ Items checked in 5?
☐ Other. Description:
☐ 3. Not feasible. State Reason:
4. Minimize Soil Compaction-County LID Handbook 2.2.4
Restrict heavy construction equipment access to planned green/open space areas
☐ Re-till soils compacted by construction vehicles/equipment
Collect & re-use upper soil layers of development site containing organic materials
☐ Other. Description: Areas adjacent to foundations, roads, and manufactured slopes must be compacted to minimum soil density standards
4. Not feasible. State Reason:
5. Drain Runoff from Impervious Surfaces to Pervious Areas-County LID Handbook 2.2.5

LID Street & Road Design
☐ Curb-cuts to landscaping
☐ Rural Swales
☐ Concave Median
☐ Cul-de-sac Landscaping Design
☒ Other. Description: Curb Inlet Shelf Basket
LID Parking Lot Design
☐ Permeable Pavements
☐ Curb-cuts to landscaping
☒ Other. Description: N/A
LID Driveway, Sidewalk, Bike-path Design
☐ Permeable Pavements
☒ Pitch pavements toward landscaping
☐ Other. Description:
LID Building Design
☐ Cisterns & Rain Barrels
☒ Downspout to swale
☐ Vegetated Roofs
☐ Other. Description:
LID Landscaping Design
☐ Soil Amendments
☒ Reuse of Native Soils
☒ Smart Irrigation Systems
☐ Street Trees
☐ Other. Description:
☐ 5. Not feasible. State Reason:

Please check the box(s) that best describes the Treatment BMP(s) selected for this project.

Biofilters
☒ Bioretention swale (Grassy Swale)
☐ Vegetated filter strip
☐ Stormwater Planter Box (open-bottomed)
☐ Stormwater Flow-Through Planter (sealed bottom)
☐ Bioretention Area
☐ Vegetated Roofs/Modules/Walls
Detention Basins
☐ Extended/dry detention basin with grass/vegetated lining
☐ Extended/dry detention basin with impervious lining
Infiltration Basins
☐ Infiltration basin
☐ Infiltration trench
☐ Dry well
☐ Permeable Paving
☐ Gravel
☐ Permeable asphalt
☐ Pervious concrete
☐ Unit pavers, ungrouted, set on sand or gravel
☐ Subsurface reservoir bed
Wet Ponds or Wetlands
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
Filtration
☐ Media filtration
☐ Sand filtration
Hydrodynamic Separator Systems
☐ Swirl Concentrator
☐ Cyclone Separator
Trash Racks and Screens

Include Treatment Datasheet as Attachment E. The datasheet should include the following:	**COMPLETED**	**NO**
1. Description of how treatment BMP was designed. Provide a description for each type of treatment BMP.	X	
2. Engineering calculations for the BMP(s)	X	

See Attachment E for LID Treatment Control BMP (Grassy Swale) descriptions and calculations.